Natural Resources and
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# Post-BMP Biological Survey of Pleasant Grove Spring, Logan County, Kentucky

*Kentucky Division of Water, Water Quality Branch, Nonpoint Source Section*

## Abstract

*A post-BMP biological evaluation of Pleasant Grove Spring, Logan County, Kentucky, was conducted in April 1998 to determine water quality conditions after the implementation of best management practices (BMPs) in the watershed. Data were compared to pre-BMP data that were collected in 1994. Two macroinvertebrate metrics indicate that improvements in water quality may have occurred, but different water conditions during the two sampling events may be more of a factor than these metrics suggest. The Index of Biotic Integrity indicates that water quality has not improved. Since there was only a short period of time between the two collections, it is recommended that this study be repeated in a few more years to allow more time for demonstrable changes in water quality to occur.*

## Introduction

A biological evaluation of Pleasant Grove Spring, in Logan County, Kentucky, was conducted in April 1998 to determine water quality conditions after the implementation of best management practices (BMPs) in the watershed. The results were compared to a pre-BMP study completed in April 1994 (KDOW, 1995a). This evaluation was a supplement to monitoring efforts conducted by the Kentucky Geological Survey (KGS) for the project entitled "Characterization and Quantification of Nonpoint Source Pollutant Loads in a Karst Aquifer Underlying an Agricultural Region," which was funded by Section 319(h) Nonpoint Source Pollution Control Grants from the Kentucky Division of Water.

Pleasant Grove Creek arises from a karst aquifer spring (Pleasant Grove Spring) located in a region with agriculture as the predominant land use. The spring is located approximately 10 km south of Russellville, Kentucky. The groundwater basin of the spring is 4,069 hectares (10,054 acres) (Currens, 1998). Pleasant Grove Spring is situated in the Interior Plateau Ecoregion, the largest in Kentucky, which extends from the Tennessee River to the mountains of Eastern Kentucky, and contains all or a part of seven major river basins. A majority of the streams within this area have been heavily influenced by anthropomorphic activities (Burr and Warren, 1986; KDOW, 1997).

## Methods

Macroinvertebrates and fishes were collected from one site on Pleasant Grove Creek just below Pleasant Grove Spring in April 1998. This site (number NPS20001) was located approximately 2.2 miles above the confluence of Pleasant Grove Creek and the Red River (see Figure 1) and was in close proximity to the established KGS monitoring station.

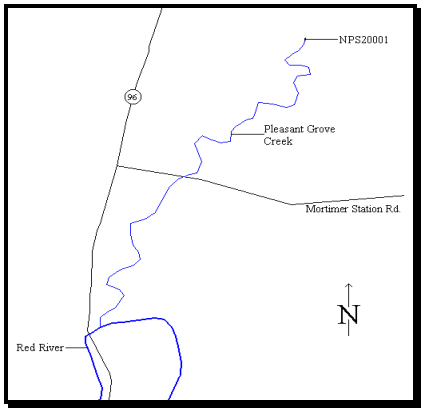


Figure 1. Location of Monitoring Site

Macroinvertebrates were collected with three traveling kicknet repetitions; these were supplemented with a one-hour qualitative pick from all habitats present at the site. Collections were picked in the field, and specimens were placed in 70% ethanol for preservation. Fishes were collected by seining for one hour, and specimens were placed in 10% formalin for preservation. Methods followed those used in the pre-BMP study and are outlined in KDOW (1995b). Habitat was also assessed following KDOW (1995b). Collections were identified to the lowest taxonomic level possible (genus and/or species) in the laboratory.

## Results and Discussion

Pleasant Grove Creek is an interrupted stream; the only hydraulic structures present at the site are the spring and an island located between the spring and the sampling site. Submerged logs or stumps and drift or log piles were present as available cover types. There was some slight sedimentation noticeable at the site, and the stream appeared to be slightly embedded. Bank stability was fair, and bank vegetation was good. Erosion potential was considered to be high, with moderate erosion noticeable, and cattle had access to the spring and creek. Aquatic

mosses, *Cladophora* sp., and *Batrachospermum* sp., dominated most of the substrate.

Only nine fish, representing three species, were collected. The IBI value for this collection was 28, which yields a classification of "Poor." This represented only a slight increase from the pre-BMP collection (Figure 2) (KDOW, 1995a). The two collections of fish had no species in common (Percent Community Similarity [$PS_c$] = 0%). The pre-BMP collection was dominated by an intermediate species (the bluegill, *Lepomis macrochirus*), and the post-BMP by an intolerant species (the banded sculpin, *Cottus carolinae*).

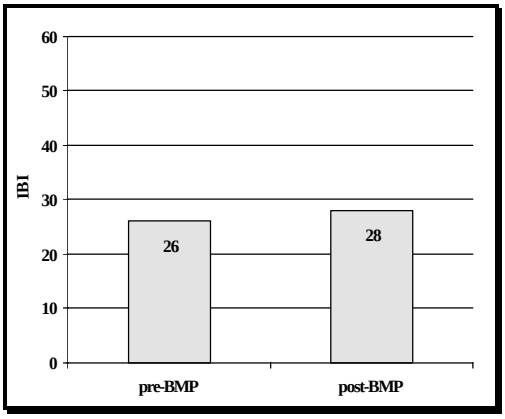


Figure 2. Pre- and post-BMP IBI Values

Two macroinvertebrate metrics, Total Number of Taxa (Taxa Richness) (TNT) and Total Number of Individuals (TNI), showed dramatic increases over the pre-BMP results (Figure 3). Post-BMP TNT was almost twice the pre-BMP value (from 21 to 41), and TNI more

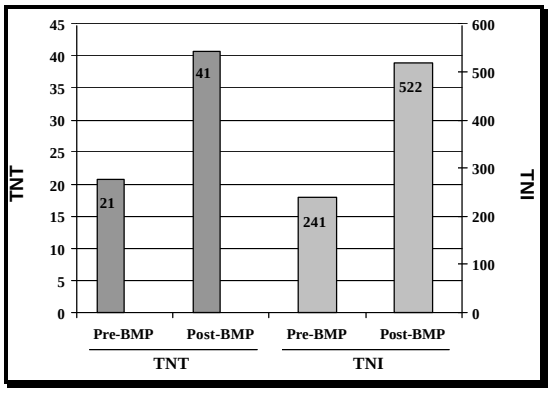


Figure 3. Pre- and Post-BMP TNT and TNI Values

than doubled (from 241 to 522). The Ephemeroptera-Plecoptera-Trichoptera (EPT) metric, which is a measure of the abundance of these pollution intolerant taxa, did not vary between the two collections (9 and 10 for pre- and post-BMP, respectively). The modified Hilsenhoff Biotic Index (mHBI) showed a slight improvement in water quality, decreasing from 6.29 to 5.42.

It should be noted that water conditions were different during the two sampling periods. Water levels were approximately two feet higher than normal, and the turbidity level was elevated (14.5 NTU) during pre-BMP sampling (KDOW, 1995a). Post-BMP sampling was during low to normal flow, and turbidity was 0 NTU (Currens, 1998).

Percent Community Similarity and Jaccard Coefficient of Community Similarity values showed that the two macroinvertebrate collections were not very similar ($PS_c$ = 32.5%, Jaccard = 0.19). These values may be revealing a temporal shift in community structure resulting from improved water quality. However, the changes in biota may be a result of differences in water conditions and not necessarily the result of improvements in water quality. With the inclusion of the fish data, it appears that water quality has not improved. Since there was only a short period of time between the two collections (four years), and the BMPs may not have been in place long enough for any demonstrable changes in water quality to be observed, it is recommended that this study be repeated again in a few years, allowing more time for changes in water quality to occur.

## Literature Cited

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